

SHARP®

FRACTION/SCIENTIFIC CALCULATOR

MODEL EL-500W

OPERATION MANUAL

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INTRODUCTION

Thank you for purchasing the SHARP Fraction/Scientific Calculator Model EL-500W. This calculator will help you understand mathematical concepts behind fraction calculation, such as simplification and reduction. After reading this manual, store it in a convenient location for future reference.

Operational Notes

- Do not carry the calculator around in your back pocket, as it may break when you sit down. The display is made of glass and is particularly fragile.
- Keep the calculator away from extreme heat such as on a car dashboard or near a heater, and avoid exposing it to excessively humid or dusty environments.
- Since this product is not waterproof, do not use it or store it where fluids, for example water, can splash onto it. Raindrops, water spray, juice, coffee, steam, perspiration, etc. will also cause malfunction.
- Clean with a soft, dry cloth. Do not use solvents or wet cloth.
- Do not drop it or apply excessive force.
- Never dispose of batteries in a fire.
- Keep batteries out of the reach of children.
- This product, including accessories, may change due to upgrading without prior notice.

SHARP will not be liable nor responsible for any incidental or consequential economic or property damage caused by misuse and/or malfunctions of this product and its peripherals, unless such liability is acknowledged by law.

- Press the RESET switch (on the back) only in the following cases. Note that pressing the RESET switch erases all data stored in memory.
 - Before using for the first time
 - After replacing the batteries
 - To clear all memory contents
 - If an abnormal condition occurs and all keys are inoperative.

If service should be required for the calculator, use only a SHARP servicing dealer, SHARP approved service facility, or SHARP repair service where available.

Hard Case



$\frac{1}{2} + \frac{1}{3} =$	ON/C 1 $\frac{1}{x \cdot y}$ 2 $+$ 1 $\frac{1}{x \cdot y}$ 3 =	5/6
$\frac{2}{5} \times \frac{1}{3} =$	2 $\frac{1}{x \cdot y}$ 5 $\times$ 1 $\frac{1}{x \cdot y}$ 3 =	2/15

How to Simplify a Fraction

Reducing to its simplest form

If the result of pressing [=] is displayed with the "SIMP" symbol, the calculation can be reduced further. Use the (SIMP) key to set the factor of the fraction to simplify, either automatically or manually.

[Automatic Simplification]

$\frac{1}{3} + \frac{2}{12} =$	ON/C 1 $\frac{1}{x \cdot y}$ 3 $+$ 2 $\frac{1}{x \cdot y}$ 12 =	SIMP 6/12
	SIMP FACTOR? SIMP = * 6 SIMP	1/2

* If you do not know a common factor, press [=]. The greatest common factor "6" will be displayed.

[Manual Simplification]

$\frac{1}{3} + \frac{2}{12} =$	ON/C 1 $\frac{1}{x \cdot y}$ 3 $+$ 2 $\frac{1}{x \cdot y}$ 12 =	SIMP 6/12
	SIMP FACTOR? SIMP = 2 * 3 =	3/6
	SIMP 3 =	1/2

* "2" is entered as a factor, and the "SIMP" will be displayed to indicate further simplification of the fraction. If the entered value is not a common factor, the cursor will be set under the value. Press [DEL] to clear the value, then enter a correct common factor. Press [ON/C] to return to the "FACTOR?" display.

Now that you have learned how to reduce a fraction to its simplest form, you can start using your calculator to perform fraction calculations quickly and efficiently.

$\frac{5}{6} + \frac{1}{14} =$	ON/C 5 $\frac{1}{x \cdot y}$ 6 $+$ 1 $\frac{1}{x \cdot y}$ 14 =	SIMP 38/42
	SIMP FACTOR? SIMP = * 16/48+12/48 SIMP	19/21

* If [=] is pressed instead of (SIMP), the number will automatically be reduced down to its simplest form with the greatest common factor.

Reducing to the lowest denominator

Prior to pressing the [=] key, a common denominator can be set to organize calculations.

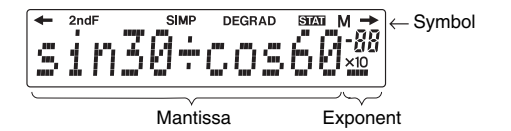
$\frac{1}{3} + \frac{1}{4} =$	ON/C 1 $\frac{1}{x \cdot y}$ 3 $+$ 1 $\frac{1}{x \cdot y}$ 4 =	1/3+1/4 SIMP DENOM.?SIMP
	48 = * 16/48+12/48 =	28/48

* Enter a common denominator of the two fractions. If the entered value is not a common denominator, the cursor will be set under the value. Press [DEL] to clear the value, then enter a correct common denominator. Press [ON/C] to return to the "DENOM.?" display.

Now that you have learned how to reduce a fraction to its lowest denominator, you can start using your calculator to perform fraction calculations quickly and efficiently.

$\frac{1}{3} + \frac{1}{4} =$	ON/C 1 $\frac{1}{x \cdot y}$ 3 $+$ 1 $\frac{1}{x \cdot y}$ 4 =	1/3+1/4 SIMP DENOM.?SIMP
	= * 12 SIMP	4/12+3/12
	=	7/12

DISPLAY



(All symbols will not be displayed simultaneously, as shown above.)

↔ : Appears when the entire equation cannot be displayed. Press (◀) or (▶) to see the remaining (hidden) section.

2ndF : Appears when (2ndF) is pressed, indicating that the functions shown in orange are enabled.

SIMP : Indicates that a fraction can be simplified further, or expressed with a lower denominator.

DEG/RAD/GRAD: Indicates angular units (Degrees, Radians and Grads) and changes each time (DRG) is pressed.

STAT : Appears when statistical mode is selected.

M : Indicates that a numerical value is stored in the independent memory.

BEFORE USING THE CALCULATOR

Key Notation Used in this Manual

In this manual, key operations are described as follows:

π	To specify π : (2ndF) π
Exp	To specify Exp : (Exp)

To access functions printed in orange above keys, press (2ndF) first.

In this manual, number entry examples are shown with ordinary numbers (i.e., "100" will be indicated instead of "1 0 0").

Power On and Off

Press [ON/C] to turn the calculator on, and (2ndF) [OFF] to turn it off.

Clearing Methods

There are three clearing methods as follows:

Clearing operation	Entry (Display)	M ⁺	STAT, ANS ⁺
ON/C	○	×	×
(2ndF) [CA]	○	×	○
RESET	○	○	○

○ : Clear × : Retain

⁺1 Independent memory M.

⁺2 Statistical data and last answer memory.

To clear the independent memory (M), press [ON/C] [STO].

Editing the Equation

- Press (◀) or (▶) to move the cursor.
- To return to the equation after getting an answer, press (◀) ((▶)).
- To delete a number, place the cursor on the number to be deleted, then press [DEL].
- To insert a number, move the cursor to the place immediately after where the number is to be inserted, then enter the number.

15 ÷ 8	ON/C 15 $\div$ 8 =	15÷8
↓	◀ ◀ DEL DEL	15
15 ÷ 3	$\div$ 3 =	15÷3
13 × 24 =	ON/C 13 $\times$ 24 =	312
↓	◀ ▶	13×24
15 × 24 =	▶ DEL 5 =	360

Priority Levels in Calculation

This calculator performs operations according to the following priority:

- Functions expressed with numerical data placed before (such as x¹, x², n!)
- y^x, $\sqrt[n]{y}$
- π
- Functions expressed with numerical data placed after (such as (–), sin, cos)
- Multiplications with the sign "×" omitted from the front of a function (such as 3cos20)
- nCr, nPr
- ×, ÷
- +, –
- Operations end commands (such as =, M+, %, DRG▶, DATA, CD)

A parenthesized calculation section has precedence over other sections of the calculation.

INITIAL SETUP

Mode Selection

Normal Mode:
Used to perform arithmetic operations and function calculations.

Statistical Mode:

Used to perform statistical operations. To enter statistical mode, press (2ndF) [STAT]. [STAT] appears on the display to indicate that the statistical mode is selected. To return to normal mode, press (2ndF) [STAT] with [STAT] on the display. [STAT] disappears as the calculator returns to normal mode.

- The mode will remain selected when the calculator is turned off.
- When executing mode selection, last answer memory will be cleared.

Scientific Notation

People who need to deal with very large and very small numbers often use a special format called exponential or scientific notation.

A number expressed in scientific notation has two parts. The first part consists of a regular decimal number between 1 and 10. The second part represents how large or small the number is in powers of 10.

While a calculation result is displayed in the floating point system, press (2ndF) [F↔E] to display the result in the scientific notation system. Pressing (2ndF) [F↔E] once again will bring back the floating point system.

To enter a number in scientific notation, press (Exp).

$(1.2 \times 10^{20}) \times (1.5 \times 10^5)$	1.2 (Exp) 20 (X) 1.5 (Exp) 5 =	1.8×10²⁵
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3 ÷ 7 =	Floating point ON/C 3 $\div$ 7 =	0.428571428
→ [Scientific notation]	(2ndF) [F↔E]	4.285714286÷10⁻⁰¹
[TAB set to 2]	(2ndF) [TAB] 2	4.29÷10⁻⁰¹
→ [Floating point]	(2ndF) [F↔E]	0.428571428

- Use (2ndF) [F↔E] to switch to the scientific notation, press (2ndF) [TAB], then give a value between 0 and 9 to set the decimal placement. To reset, press (2ndF) [TAB] 9.
- The number will be displayed in scientific notation if the floating point value does not fit in the following range: 0.000000001 ≤ x | ≤ 9999999999
- The last decimal digit in scientific notation will be rounded off.

Correcting Entered Data

Correction prior to pressing [DATA]:

Delete incorrect data with [ON/C].

Correction after pressing [DATA]:

Press (▶) to confirm the latest entry and press (2ndF) [CD] to delete it.

Calculating Statistical Quantities

Score	Number of Persons	(2ndF) [CA]	(RCL) 5 [DATA]	n =	STAT
30	5	30 (RCL) 5 [DATA]		n = 5.	
40	3	40 (RCL) 3 [DATA]		n = 8.	
40	3	50 (RCL) 10 [DATA]		n = 18.	
50	10	60 (RCL) 12 [DATA]		n = 30.	
60	12	70 (RCL) 13 [DATA]		n = 43.	
70	13	80 (RCL) 9 [DATA]		n = 52.	
80	9	90 (RCL) 7 [DATA]		n = 59.	
90	7	100 (RCL) 3 [DATA]		n = 62.	
100	3	(2ndF) [Σ]		65.32258065	
		(2ndF) [Σx]		18.52935128	
		(2ndF) [Σx ²]		18.37931358	
		(2ndF) [n]		n = 62.	
		(2ndF) [Σx]		Σx = 4050.	
		(2ndF) [Σx ²]		Σx² = 285500.	

- If both the resulting digits and the function name (such as Σx=) cannot be contained in the display, only the resulting value will be displayed; the function name will not be displayed.

Statistical Calculation Formulas

$$\bar{x} = \frac{\sum x}{n}$$
$$\sigma x = \sqrt{\frac{\sum x^2 - n\bar{x}^2}{n}}$$
$$s x = \sqrt{\frac{\sum x^2 - n\bar{x}^2}{n - 1}}$$
$$\Sigma x = x_1 + x_2 + \dots + x_n$$
$$\Sigma x^2 = x_1^2 + x_2^2 + \dots + x_n^2$$

(n: number of samples)

In the statistical calculation formulas, an error will occur:

- the absolute value of the intermediate result or calculation result is equal to or greater than 1 × 10¹⁰⁰.
- the denominator is zero.
- an attempt is made to take the square root of a negative number.

ERROR AND CALCULATION RANGES

Errors

An error will occur if an operation exceeds the calculation ranges, or if a mathematically illegal operation is attempted. If an error occurs, pressing (◀) (or ▶) automatically moves the cursor back to the place in the equation where the error occurred. Edit the equation or press [ON/C] to clear the equation.

Error Codes and Error Types

- Syntax error (Error 1):
 - An attempt was made to perform an invalid operation.

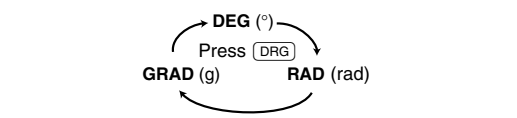
Ex. 2 (+) (–) 5 (=)

Calculation error (Error 2):

- The absolute value of an intermediate or final calculation result equals or exceeds 10¹⁰⁰.
- An attempt was made to divide by 0.
- The calculation ranges were exceeded while performing calculations.

Determination of the Angular Unit

In this calculator, the following three angular units (degrees, radians, and grads) can be specified.



SCIENTIFIC CALCULATIONS

- Select the normal mode.
- In each example, press [ON/C] to clear the display before performing the calculation.

Arithmetic Operations

12+16×3=	ON/C 12 $+$ 16 $\times$ 3 =	60.
350–120÷4=	350 $-$ 120 $\div$ 4 =	320.
72×(–12)–150=	72 $\times$ (–) 12 $-$ 150 =	–1014.
(5+21)×(30–16)=	(5) $+$ 21 $\times$ (30) $-$ 16 =	364.
(6×10 ³)÷(2×10 ^{–4})=	(6) $\times$ 10 $\div$ (2) $\times$ 10 =	30000000.

Constant Calculations

In constant calculations, the addend becomes a constant. Subtraction and division are performed in the same manner. For multiplication, the multiplicand becomes a constant.

245+60=	ON/C 245 $+$ 60 =	305.
12÷60=	12 $\div$ 60 =	72.
150–20=	150 $-$ 20 =	130.
250–20=	250 $-$ 20 =	230.
200÷4=	200 $\div$ 4 =	50.
180÷4=	180 $\div$ 4 =	45.
15×3=	15 $\times$ 3 =	45.
15×10=	10 =	150.

Functions

- For each example, press [ON/C] to clear the display.
- Before starting calculations, specify the angular unit.
- The results of inverse trigonometric functions are displayed within the following range:

	$\theta = \sin^{-1} x, \theta = \tan^{-1} x$	$\theta = \cos^{-1} x$
DEG	$-90 \leq \theta \leq 90$	$0 \leq \theta \leq 180$
RAD	$-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}$	$0 \leq \theta \leq \pi$
GRAD	$-100 \leq \theta \leq 100$	$0 \leq \theta \leq 200$

sin60[°]=	ON/C sin 60 =	0.866025403
cos $\frac{\pi}{4}$ [rad]=	DRG cos () (2ndF) π $\div$ 4 =	0.707106781
tan ^{–1} 1=[g]	DRG (2ndF) tan^{–1} 1 =	50.
ln 20 =	(2ndF) ln 20 =	2.995732274
log 50 =	(2ndF) log 50 =	1.698970004
e ³ =	(2ndF) e^x 3 =	20.08553692

Depth error (Error 3):

- The available number of buffers was exceeded. (There are 8 buffers* for numeric values and 16 buffers for calculation instructions). * 4 buffers in STAT mode.

Equation too long (Error 4):

- The equation exceeded its maximum input buffer (159 characters). An equation must be shorter than 159 characters.

Calculation Ranges

• Within the ranges specified below, this calculator is accurate to ±1 of the least significant digit of the mantissa. However, a calculation error increases in continuous calculations due to accumulation of each calculation error. (This is the same for y^x, $\sqrt[n]{y}$, etc. where continuous calculations are performed internally.) Additionally, a calculation error will accumulate and become larger in the vicinity of inflection points and singular points of functions.

- Calculation range: ±10^{–99} ~ ±9.999999999×10⁹⁹ and 0.
- If the absolute value of an entry or a final or intermediate result of a calculation is less than 10^{–99}, the value is considered to be 0 in calculations and in the display.

Function	Dynamic Range
sin x cos x tan x	DEG : $ x < 10^{10}$ (tan x : $ x \neq 90(2n-1)^*$) RAD : $ x < \frac{\pi}{180} \times 10^{10}$ (tan x : $ x \neq \frac{\pi}{2} \times (2n-1)^*$) GRAD : $ x < \frac{10}{9} \times 10^{10}$ (tan x : $ x \neq 100(2n-1)^*$)
$\sin^{-1}x$ $\cos^{-1}x$	$ x \leq 1$
$\tan^{-1}x$	$ x < 10^{100}$
ln x log x	$10^{-99} \leq x < 10^{100}$
y^x	$\cdot y > 0: -10^{100} < x \log y < 100$ $\cdot y = 0: 0 < x < 10^{100}$ $\cdot y < 0: x = n (0 < x < 1; \frac{1}{x} = 2n-1, x \neq 0)^*$, $-10^{100} < x \log y < 100$
$x_{\sqrt[n]{y}}$	$\cdot y > 0: -10^{100} < \frac{1}{x} \log y < 100 (x \neq 0)$ $\cdot y = 0: 0 < x < 10^{100}$ $\cdot y < 0: x = 2n-1 (0 < x < 1; \frac{1}{x} = n, x \neq 0)^*$, $-10^{100} < \frac{1}{x} \log y < 100$
e^x	$-10^{100} \leq x \leq 230.2585092$
10^x	$-10^{100} \leq x < 100$
x^2	$ x < 10^{90}$
$\sqrt{x}$	$0 \leq x < 10^{100}$
x^{-1}	$ x < 10^{100} (x \neq 0)$
n!	$0 \leq n \leq 69^*$
nPr nCr	$0 \leq r \leq n \leq 69^*$
DRG▶	DEG→RAD, GRAD→DEG : $ x < 10^{100}$ RAD→GRAD : $ x < \frac{\pi}{2} \times 10^{98}$